INSTRUCTION MANUAL

D-150A SERIES II
DUAL-CHANNEL
POWER AMPLIFIER

crown

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DUAL-CHANNEL
POWER AMPLIFIER

CROWN INTERNATIONAL, INC. 1718 W. MISHAWAKA RD. ELKHART, INDIANA 46517

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FULL THREE-YEAR WARRANTY

SUMMARY OF WARRANTY

We, CROWN INTERNATIONAL, INC., 1718 West Mishawaka Road, Elkhart, Indiana 46517 (Warrantor) warrant to you, the ORIGINAL PURCHASER AND ANY SUBSEQUENT OWNER of each NEW Crown product, for a period of three (3) years from the date of purchase by the original purchaser (warranty period) that the product is free of defects in materials or workmanship and will meet or exceed all advertised specifications for such a product.

ITEMS EXCLUDED FROM WARRANTY

We are not responsible for product failure caused by misuse, accident or neglect. This warranty does not extend to any product on which the serial number has been defaced, altered, or removed. It does not cover damage to speakers or any other products resulting from Crown product failure. It does not cover defects or damage caused by your use of unauthorized modifications, parts, or service. It also excludes batteries and damage caused by leaky or defective batteries.

WHAT WE WILL DO

We will remedy any defect in materials or workmanship by repair, replacement, or refund. We may not elect refund unless you agree, or unless we are unable to provide replacement, and repair is not practical or cannot be timely made. If a refund is elected, then you must make the defective or malfunctioning component available to Crown free and clear of all liens or other encumbrances. The refund will be equal to the actual purchase price, not including interest, insurance, closing costs, and other finance charges less a reasonable depreciation on the product from the date of original purchase. Warranty work can only be performed at our authorized service centers or at the Crown factory. We will remedy the defect and ship the product from the service center or Crown factory within a reasonable time after receipt of the defective product at the authorized service center or the Crown factory. All expenses in remedying the defect, including shipping costs in the United States, will be borne by Crown. (Purchaser must bear the expense of shipping the product between any foreign country and the port of entry in the United States and all taxes, duties, and other custom's fee for such foreign shipments).

HOW TO OBTAIN WARRANTY SERVICE

You must notify us of your need for warranty service not later than ninety (90) days after expiration of the warranty period. We will give you written notice of the dealer service centers to whom you may deliver the product, or we will give you an authorization to return it for factory service. All components must be shipped in a factory pack, which, if needed, may be obtained from Crown free of charge. Corrective action will be taken within a reasonable time of the date of receipt of the defective product by us or our service center. If the repairs made by Crown or the authorized service center are not satisfactory, notify Crown or the authorized service center immediately.

DISCLAIMER OF CONSEQUENTIAL AND INCIDENTAL DAMAGES

YOU ARE NOT ENTITLED TO RECOVER FROM US ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES RESULTING FROM ANY DEFECT IN OUR PRODUCT. THIS INCLUDES ANY DAMAGE TO ANOTHER PRODUCT OR PRODUCTS RESULTING FROM SUCH A DEFECT. **SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATIONS OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.**

WARRANTY ALTERATIONS

NO PERSON HAS THE AUTHORITY TO ENLARGE, AMEND, OR MODIFY THIS WARRANTY. THE WARRANTY IS NOT EXTENDED BY THE LENGTH OF TIME WHICH YOU ARE DEPRIVED OF THE USE OF THE PRODUCT. REPAIRS AND REPLACEMENT PARTS PROVIDED UNDER THE TERMS OF THIS WARRANTY SHALL CARRY ONLY THE UNEXPIRED PORTION OF THIS WARRANTY.

DESIGN CHANGES

We reserve the right to change the design of any product from time to time without notice and with no obligation to make corresponding changes in products previously manufactured.

LEGAL REMEDIES OF PURCHASER

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE. No action to enforce this Warranty shall be commenced later than ninety (90) days after expiration of the warranty period.

CROWN INTERNATIONAL, INC.
1718 West Mishawaka Road, Elkhart, Indiana 46517

THIS STATEMENT OF WARRANTY SUPERSEDES ALL OTHERS CONTAINED IN THIS MANUAL.

12/81

The information furnished in this manual does not include all of the details of design, production, or variations of the equipment. It does not cover all the possible contingencies which may arise during operation, installation, or maintenance. Should special problems arise, or further information be desired, please contact the Crown International Customer Services Department.

Crown International
1718 W. Mishawaka Rd.
Elkhart, Indiana 46517
Ph: (219) 294-5571

WARNING

TO PREVENT SHOCK OR FIRE HAZARD DO NOT EXPOSE TO RAIN OR MOISTURE!

CAUTION

TO PREVENT ELECTRIC SHOCK DO NOT USE THIS (POLARIZED) PLUG WITH AN EXTENSION CORD, RECEPTACLE OR OTHER OUTLET UNLESS THE BLADES CAN BE FULLY INSERTED TO PREVENT BLADE EXPOSURE.

ATTENTION

POUR PREVENIR LES CHOCS ELECTRIQUES NE PAS UTILISER CETTE FICHE POLARISEE AVEC UN PROLONGATEUR. UNE PRISE DE COURANT OU UNE AUTRIE SORTIE DE COURANT, SAUF SI LES LAMES PEUVENT ETRE INSEREES A FOND SANS EN LAISSER AUCUNE PARTIE A DECOUVERT.

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SECTION 1
GENERAL INFORMATION

1.1 Introduction

The purpose of this manual is to acquaint you with the operational characteristics of the Crown D-150A Series II (IOC equipped) power amplifier. (Fig. 1.1) Even though the manual is divided for quick reference, a careful reading of the entire manual will ensure maximum performance and enjoyment. We suggest that at this time you read the Crown warranty located inside the title page. Adherence to the requirements and conditions set forth in the warranty will help to assure your satisfaction with the Crown D-150A Series II power amplifier.

Fig. 1.1 D-150A Series II

1.2 Purpose of Equipment/Features

The D-150A Series II is a dual-channel medium power amplifier for low distortion amplification from DC to 20KHz with operation into loads of 4 ohms and higher. The unit features extremely low harmonic and intermodulation distortion, very low noise, highest "damping factor," with "IOC" (input output comparator) circuitry and indicators, monophonic capability and quality parts and workmanship.

1.3 Service Policies

Due to the sophisticated circuitry of your unit, only qualified, fully trained technicians should be allowed to service it. Please observe the following label on the rear panel. **CAUTION: TO PREVENT ELECTRIC SHOCK DO NOT OPEN. NO USER SERVICABLE PARTS INSIDE. REFER SERVICING TO A QUALIFIED TECHNICIAN.**

For service, return the unit to the factory in the original packing or in replacement packing obtainable from the Crown factory. For warranty service, the unit must be returned to the factory or an approved service station (Amcron customers consult your local representative). In either case, fill out and enclose the Service Information form located at the rear of this manual. This will help to ensure a speedy and effective response.

Crown will pay shipping costs (in the U.S.) for warranty service upon receiving copies of all shipping receipts.

Before returning your unit to the factory for service, authorization should be obtained from the Crown Technical Service Department. All shipments should be sent UPS or truck freight (insured). The factory will then return your serviced unit by one of the above methods.

Upon receipt of the warranty registration card from your dealer, Crown will automatically send you the Crown Care Card. This is a plastic, wallet-sized card (Fig. 1.2) This is your warranty certificate.

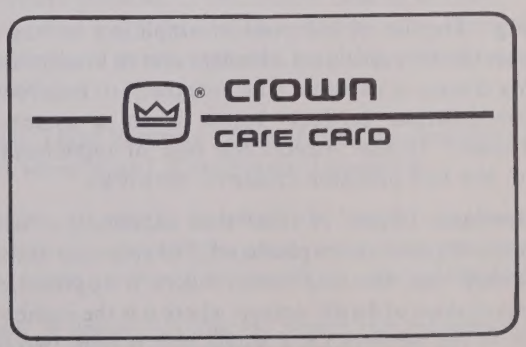


Fig. 1.2 Crown Care Card

Printed on it will be your name, the model number and serial number of your new Crown unit, and the expiration date of the warranty on that product.

Crown will replace lost Care Cards at no charge and will issue new cards for repurchased units.

When you need service for your unit from an authorized Crown Service Station, simply present your Crown Care Card. It is all the identification you need. With it, the service station can promptly initiate any needed paperwork. It will save you time and effort.

The Crown Care Card is also your proof of ownership should you need it for insurance or legal reasons. It is also a convenient place to look for the serial number should you want to write to the factory for any reason.

1.4 Glossary of Terms

A-B Test: Evaluating relative performance of two (or more) components or systems by changing quickly from one to the other. Most high fidelity dealers have A-B test facilities.

AGC: Automatic Gain Control. A type of circuit used to maintain the output volume of a receiver constant, regardless of variations in the signal strength applied to the receiver.

Attenuation: A decrease in signal magnitude from one point to another, or the process causing this decrease.

Balanced Input: A three wire input system where the voltages and currents in two of the wires are equal in magnitude but opposite in polarity with respect to ground which is the third wire. The impedance of a balanced input is usually low. (600 ohms or less)

Balun: A device used for the transformation from an unbalanced line or system to a balanced line or system, or vice versa. The term is derived from balance to unbalance transformer.

Bandpass Filter: A filter that allows transmission of alternating signals whose frequencies are between given upper and lower cutoff values, while substantially attenuating all frequencies outside this band.

Biamp: The use of independent amplifiers to feed the bass and treble portions of a loudspeaker or loudspeakers with a crossover network. The purpose is to help reduce intermodulation between bands when a system is overloaded. It also reduces the cost of implementing good, low loss precision crossover networks.

Butterworth Filter: A filter that exhibits the flattest possible response in the passband. The response rolls off smoothly into the stop band, where it approaches a constant slope of 6**n** db/octave; where **n** is the number of poles in the network,i.e. a single pole is 6dB, two pole 12dB, 3 pole 18dB, etc.

Capture Ratio: The ability of a receiver to reject a weaker station whose frequency is the same as that of the desired station. This measurement will be in dB. The smaller the figure, the better the spec.

Ceramic Filter: A bandpass filter using a piezoelectric substrate material.

Channel: A channel is a complete sound path. A single channel, or monophonic system, has one channel. A stereophonic system has at least two full channels designated as left (A) and right (B). Monophonic material may be played through a stereo system; both channels will carry the same signal. Stereo material, if played on a monophonic system, mixes and emerges as a monophonic sound.

Channel Separation: Specified in dB, channel separation is the ratio of the measurable output of one channel to the unwanted output of the (undriven)opposite channel.

Clipping: The truncation of peaks of a signal due to exceeding the operating range of an electronic circuit. Normally, it refers to the result of voltage limitations in the circuit.

Corner Frequency: The frequency at which a filter goes from a condition of passing the signal unattenuated to "rolling off" or attenuating the signal according to its frequency. It is sometimes referred to as the "cutoff" frequency or the "break" frequency. It is also defined as 3dB below the unattenuated output level of the signal.

Cross Modulation: In FM signals, a type of intermodulation that occurs when the carrier of the desired signal is modulated by an undesirable signal. Each signal is of independent origin.

Crossover Frequency: The frequency at which a dividing network delivers equal power to the upper and lower frequency channels when both are terminated in specified loads.

Crossover Network: A selective network used to divide the audio frequency output of an amplifier into two or more bands of frequency. The band below the crossover frequency is fed the woofer loudspeaker while the high frequency band is fed to the tweeter. Also called dividing network and loudspeaker dividing network.

Crosstalk: Signal leakage from one signal source into another.

Damping: Controlling of vibrations, response, or resonances which if unchecked, would cause coloration of the sound.

Damping Factor: A numerical indication of an amplifier's ability to decrease unwanted loudspeaker movements. Damping factor can be found by dividing the load impedance by the amplifier's output impedance.

Decibel: A numerical expression of acoustic or electrical ratios, such as the relative intensity of a sound or the relative strength of a signal. One (dB) is about the smallest change in sound perceptible to the ear.

Decoder: A matrix of logic elements that selects one or more output channels according to the combination of input signals present. Can be used in FM to recover stereo signals of a stereo encoded multiplex transmisssion.

De-emphasis: In FM signals, restoring the pre-emphasized (for proper transmission characteristics) signal to result in a "flat" frequency response curve.

Distortion: Unwanted noise, or sounds which didn't exist in the studio when the original recording was made. Harmonic distortion produces tones harmonically related to a single, pure tone. Intermodulation distortion (IM) introduces new tones caused by mixing of two or more original tones. Phase distortion, or non-linear phase shift, disturbs timing sequence between a tone and its related overtones. Distortion which creates new spectra are expressed in percentages and phase distortion in degrees of phase shift or seconds of group delay vs. frequency errors.

Dynamic Range: The difference between the most intense and the least intense levels in a sound system.

EAROM: EAROM stands for Electrically Alterable Read Only Memory which is an integrated circuit chip used to store information without power applied (used in the FM1).

Equalization: Frequency response manipulation to meet the requirements of recording, and an inverse manipulation on playback to restore the original. Also known as compensation for acoustic problems of listening rooms.

Feedback: Sending a "part" of a system's output back to the input. Positive feedback may lead to unstable conditions such as PA system "howling" due to sound from the speakers being fed back thru the microphone and amplified again. Another form is low frequency interference created when vibrations from loudspeakers are picked up by the cartridge and amplified again. However, carefully controlled negative feedback in electronic circuits can be used to help reduce distortion and control stability.

Flutter: Rapid variation in the speed of a turntable or tape transport. Flutter causes a wavering of musical pitch.

Frequency Response: This term indicates any amplitude variations in a system output signal with respect to frequency. This measurement is made with a constant level input signal.

Gain: The ratio of an amplifer's output voltage to its input voltage.

Headroom: Stated in dB, headroom is the difference between the signal level and the limits of the sound system ie; the ratio of power available to power used.

Hertz: As in cycles-per-second, not rental agency.

High Pass/Low Pass Filter: High pass - a filter having a single transmission band extending from some critical, or cutoff, frequency other than zero, up to infinite frequency. Low pass - a filter network which passes all frequencies below a specified frequency with little or no loss but discriminates strongly against higher frequencies.

IF: An Intermediate Frequency is a frequency to which a signal wave is shifted locally as an intermediate step in FM transmission or reception.

Image Response: Response of a superheterodyne receiver to the image frequency, as compared to the response to the desired frequency.

Input Sensitivity: The input voltage required to drive an amplifier to its rated output.

IOC™: Stands for Input-Output Comparator. An extremely sensitive Crown circuit used to indicate, via a front panel LED, the fact that the operating limits of an amplifier are being exceeded resulting in output non-linearity.

LED: Light Emitting Diode. A PN junction that emits light when biased in the forward direction.

Limiter: A circuit in which the output amplitude is substantially linear with regard to the input up to a pre-determined value and substantially constant thereafter.

Load: A device that absorbs power and converts it into the desired form.

LSI: Large Scale Integration is an integrated circuit chip housing a large number of active devices.

Mixer: A device having two or more inputs, usually adjustable, and a common output, which operates to combine linearly in a desired proportion the separate input signals to produce an output signal.

Monitoring Amplifier: A power amplifier used primarily for evaluation and supervision of a program.

Multipath Delay: In FM the existence of more than one signal path between transmitter and receiver. The two signals arriving at different times causes distortion.

Music Power: This rating expresses the ability of an amplifier to handle short duration power peaks, as opposed to sustained power levels. An amplifier may only be capable of putting out 45 watts if that level is continuous, but it may be able to handle 60 watt peaks (such as might occur in a musical passage), if the peaks do not last too long.

Muting Circuit: In FM, a circuit which cuts off the receiver output when the r-f carrier reaching the first detector is at or below a pre-determined intensity.

Pre-emphasis: A process in a system designed to emphasize the magnitude of some frequency components with respect to the magnitude of others, to reduce adverse effects, such as noise, in subsequent parts of the system.

PLL: Phase Lock Loop; a circuit for synchronizing a variable local oscillator with the phase of a transmitted signal. Can be used in FM as a synthesizer circuit as well as a stereo decoder in the multiplex system.

Polar Curve: A pattern used to show the directional characteristics of antennas, microphones or speakers.

Quartz Crystal: A complete assembly, comprising a piezoelectric quartz-crystal element mounted, housed, and adjusted to the desired frequency. Such a device is commonly employed for purposes of frequency control, frequency measurment and electric wave filtering.

Rotor: A motor driven assembly which turns an antenna so that it can be aimed in the direction of best reception.

SAW Filter: Surface Acoustic Wave; commonly used as a bandpass filter. Device transmitts surface acoustic waves on a piezoelectric substrate. Used in the FMI for low FM distortion.

Selectivity: In FM a measure of the extent to which a receiver is capable of differentiating between the desired signal and disturbances at other frequencies.

Sensitivity: A receiver specification indicating the smallest input signal strength required to produce an output signal whose characteristics are standardized and used as a reference.

Signal: A visible, audible or other conveyor of information.

Signal-To-Noise-Ratio: Measured in dB, signal to noise ratio is a relative term meaning the ratio between the desired output signal and the interference or noise. A typical figure would be 60dB which stands for a ratio of 1000-1.

Superheterodyne: A method of receiving radio waves in which the process of heterodyne reception is used to convert the voltage of the received wave into a voltage of an intermediate, but usually superaudible frequency, that is then detected.

Synthesizer: A Phase Lock Loop (PLL) system which constructs an oscillator signal by phase locking it to a reference times (X) the ratio of two integers (reference is usually a quartz crystal osciallator).

Triamp: The use of three separate amplifiers to drive the high, middle and low frequency sections of a speaker system.

Varactor: A two terminal semiconductor device in which the electrical characteristic of primary interest is a voltage-dependent capacitance. Used in FM tuner inputs for voltage controlled timing.

Wow: Distortion caused in sound reproduction by slow variation in speed of the turntable or tape. (See flutter.)

SECTION 2
SPECIFICATIONS AND PERFORMANCE

2.1 General Specifications

Hum and Noise (20Hz-20KHz): 110dB below rated output.

Phase Response: +0, -15°, DC-15KHz at 1 watt.

Input Impedance: 25K ohms, ±30%.

Amplifier Output Protection: Short, mismatch, and open circuit proof. Limiting is instantaneous with no flyback pulses, thumps, cutout, etc. No premature limiting on transients.

Overall Protection: AC line fused. Thermal switch in AC line protects against overheating caused by insufficient ventilation. Controlled slewing-rate voltage amplifiers protect overall amplifier against RF burnouts. Input overload protection is furnished by internal resistance at inputs of amp.

DC Output Offset (Shorted Input): 10 millivolts or less, internally adjustable to zero.

Turn-On: Instantaneous, with minimum thumps and no program delay.

Circuit: Wideband multiple feedback loop design utilizing one linear IC (dual op-amp), total equivalent of 48 transistors, 22 signal diodes, 3 zener diodes, and 6 rectifier diodes.

Power Supply: Massive computer-grade filter capacitors store over 20 joules of energy. Two regulated supplies for complete isolation and stability.

Power Requirements: Requires 50-400HZ AC on 100, 120, 200, 220, or 240V ±10% operation. Draws 30 watts or less on idle, 250 watts at 160 watts total output.

Heat Sinking: The entire amplifier is used as a heat sink. 3/16 inch thick chassis acts as a heat sink along with auxiliary fins.

Chassis: All aluminum construction for maximum heat conduction and minimum weight.

Controls: Independent level controls are mounted on the front panel. Power switch with associated pilot light is on front panel. Non-interacting DC balance controls are mounted on main PC board under electronics cover. A mono-stereo switch is located next to the input jacks on the rear panel.

Connectors: Input - ¼ inch phone jacks. Output - color coded binding posts. AC line - 3-wire (grounded) male connector on 5 foot cable.

Dimensions: 19 (48.3cm) inches long, 5¼ (13.3cm) inches high, 8¾ (22.2cm) inches deep (from mounting surface of front panel)

Weight: 24 pounds (10.9kg).

Finish: Polyester vinyl coated front panel with Lexan insert.

2.2 Monaural Specifications

Output Power: 160 watts minimum RMS into a 16 ohm load over a bandwidth of 1Hz-20KHz at a rated RMS sum total harmonic distortion of 0.05% of the fundamental output voltage.

Frequency Response 1KHz Power: ±0.15dB DC-20KHz at 1 watt into 16 ohms; ±1dB DC-60KHz. 180 watts RMS into 16 ohms.

Harmonic Distortion: Less than 0.001% from 20-400Hz and increasing linearly to 0.05% at 20KHz at 160 watts into 16 ohms.

I.M. Distortion S.M.P.T.E. (60Hz-7KHZ 4:1): Less than 0.05% from 0.01 watts to 0.25 watts and less than 0.01% from 0.25 watts to 160 watts into 16 ohms, per channel.

Slewing Rate: 12 volts per microsecond.

Damping Factor: Greater than 400, DC-400Hz into 16 ohms.

Output Impedance: Less than 30 milliohms in series with less than 6 microhenries.

Load Impedance: Rated for 16 ohm usage; safely drives any load including completely reactive loads.

Voltage Gain: 41.2±2% or 32.3±0.2dB at maximum gain.

Input Sensitivity: 1.19 volts ±2% for 160 watts into 16 ohms.

Output Signal: Balanced, single channel.

2.3 Stereo Specifications

Output Power: 80 watts per channel minimum RMS (both channels operating) into an 8 ohm load over a bandwidth of 1Hz-20KHz at a rated RMS sum total harmonic distortion of 0.05% of the fundamental output voltage.

Frequency Response: ±0.1dB DC-20KHz at 1 watt into 8 ohms; ±1dB DC-100KHz.

1KHz Power: 90 watts RMS into 8 ohms, per channel, both channels operating. 0.1% total harmonic distortion.

Harmonic Distortion: Less than 0.001% from 20Hz-400Hz, and increasing linearly to 0.05% at 20KHz at 80 watts RMS per channel into 8 ohms.

I.M. Distortion S.M.P.T.E. (60Hz-7KHz 4:1): Less than 0.05% from 0.01 watt to 0.25 watts and less than 0.01% from 0.25 watts to 80 watts into 8 ohms, per channel.

Slewing Rate: 6 volts per microsecond (slewing rate is the maximum value of the first derivative of the output signal, or the maximum slope of the output signal).

Damping Factor: Greater than 400, DC-400Hz into 8 ohms.

Output Impedance: Less than 15 milliohms in series with less than 3 microhenries.

Load Impedance: Rated for 8 ohm usage; safely drives any load including completely reactive loads.

Voltage Gain: 20.6 ±2% or 26.3±.2dB at maximum gain.

Input Sensitivity: 1.19 volts±2% for 80 watts into 8 ohms.

Output Signal: Unbalanced, dual channel.

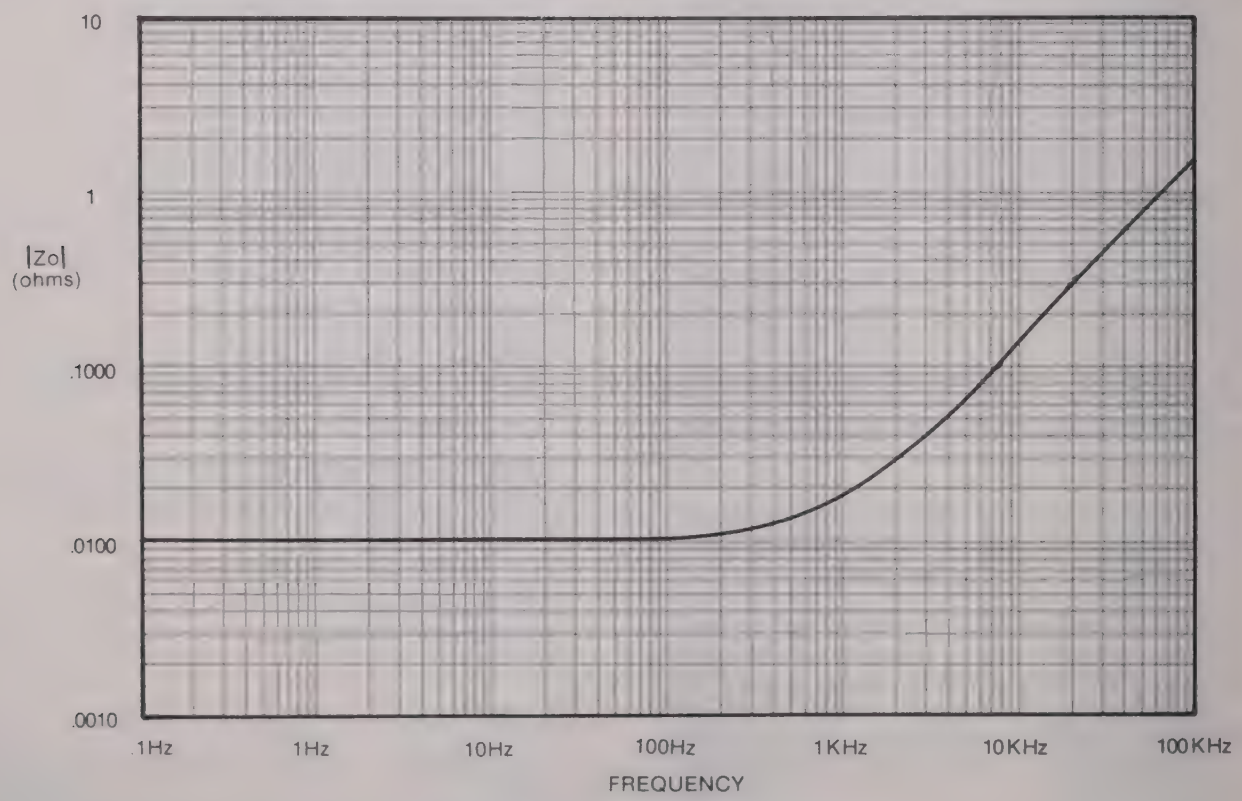


Fig. 2.1 Nominal Output Impedance

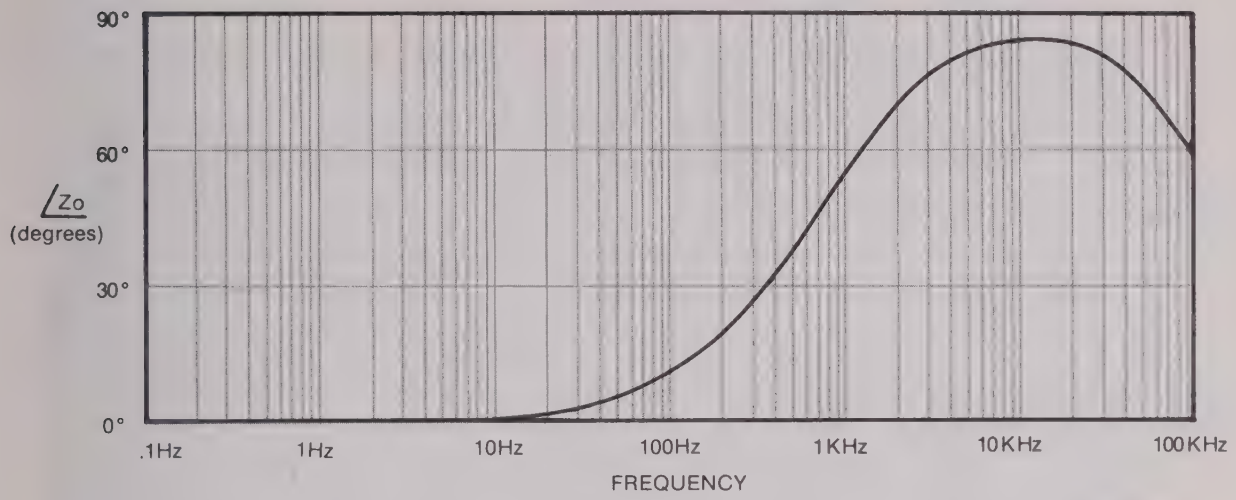


Fig. 2.2 Nominal Output Phase Angle

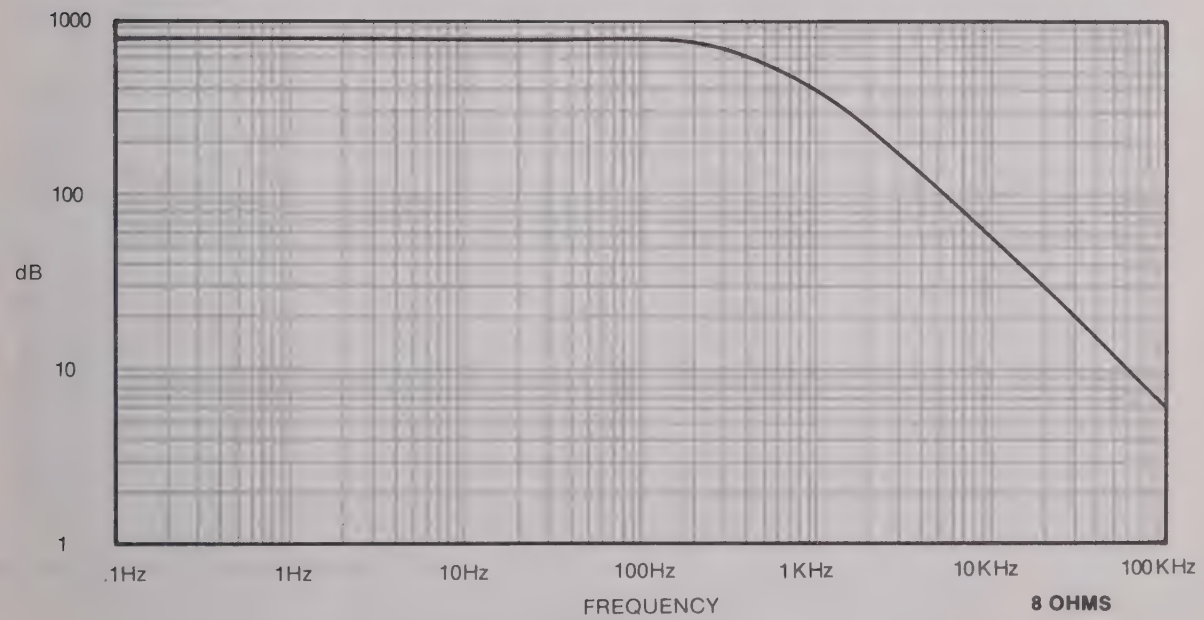


Fig. 2.3 Nominal Damping Factor

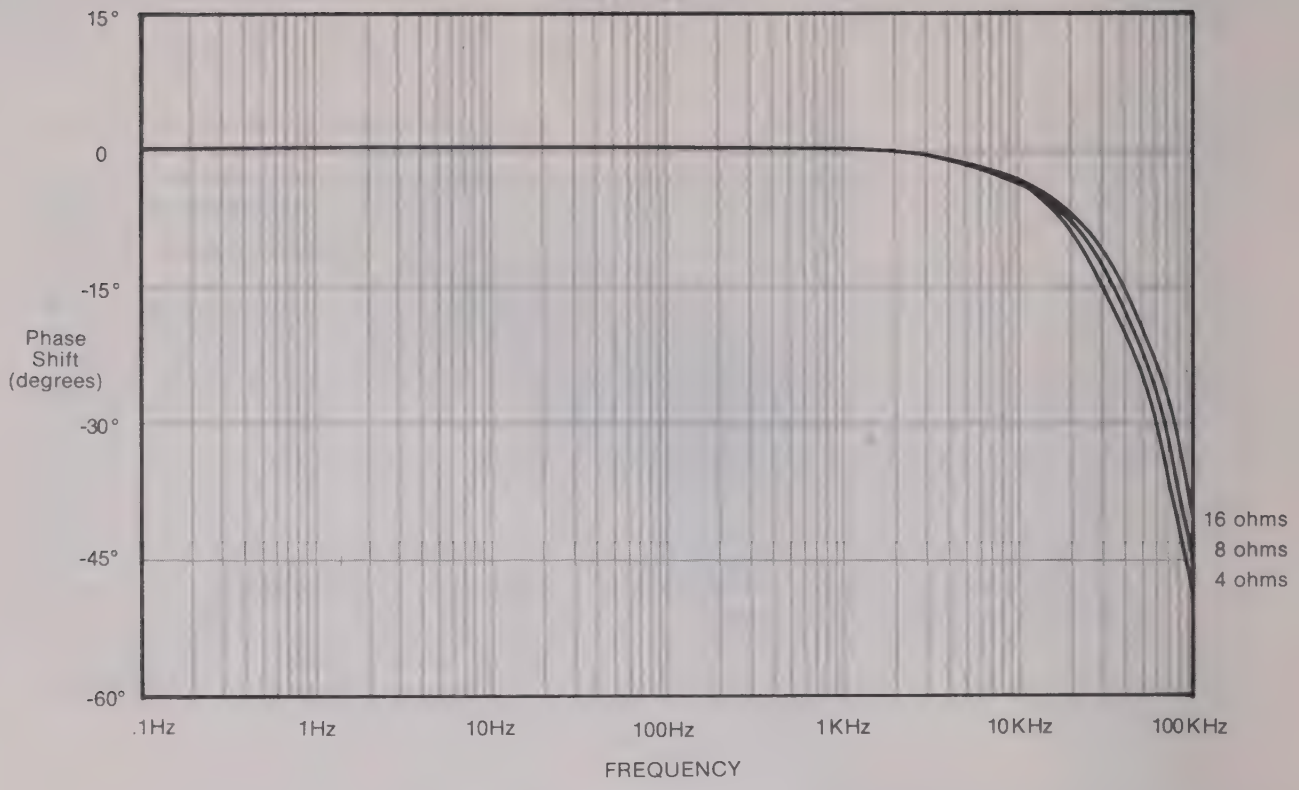


Fig. 2.4 Nominal Phase Response

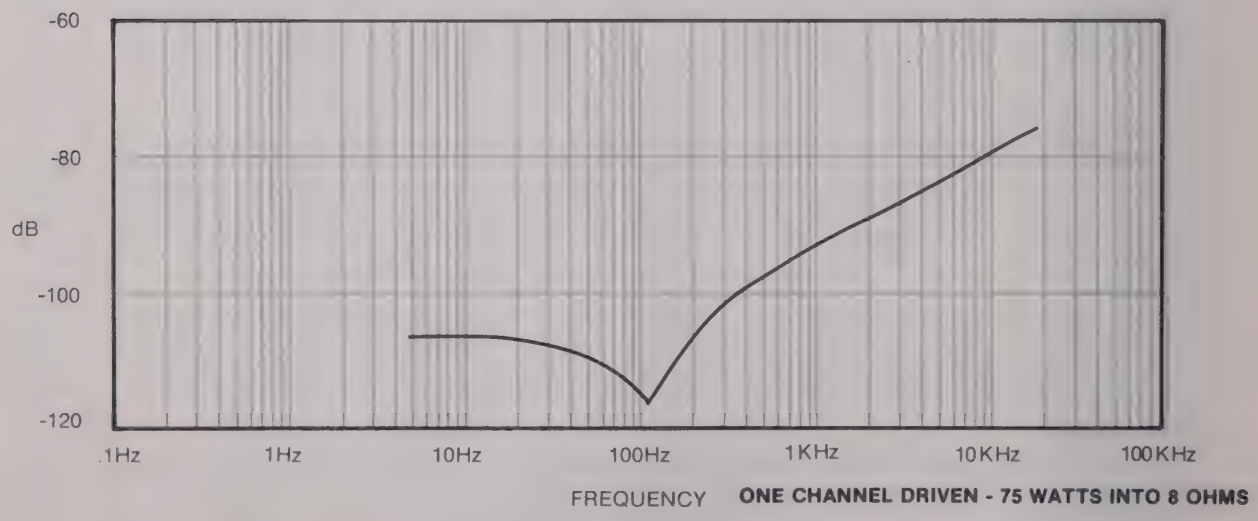
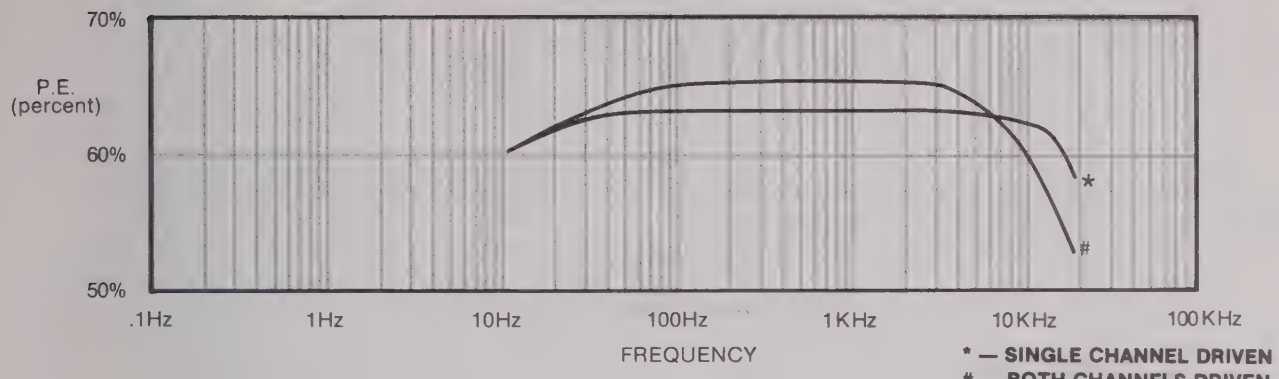
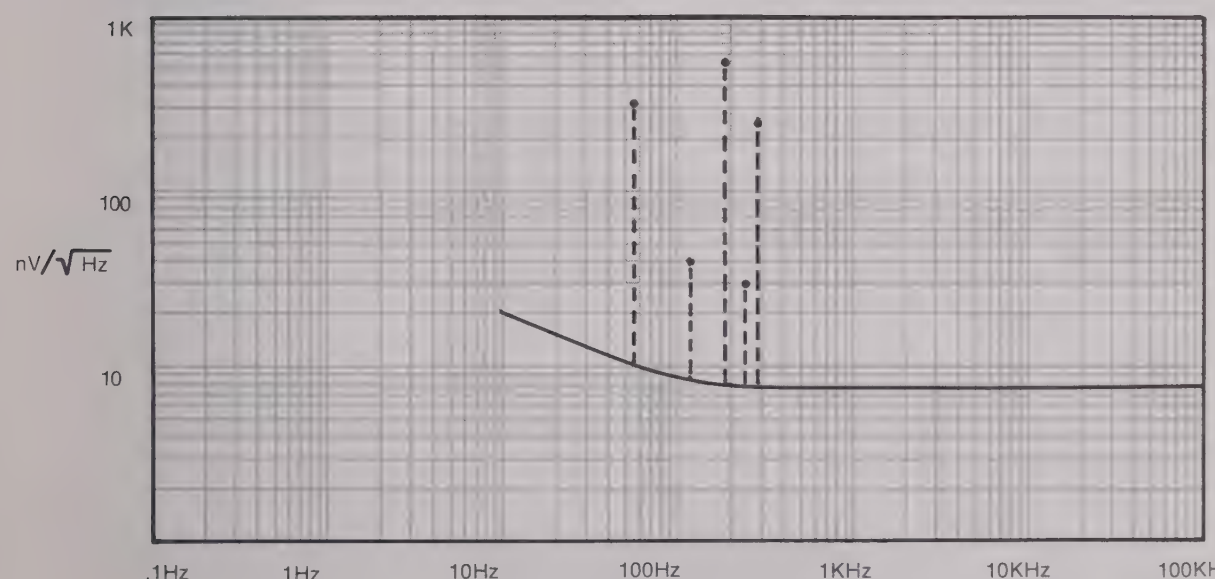


Fig. 2.5 Nominal Crosstalk



* — SINGLE CHANNEL DRIVEN
# — BOTH CHANNELS DRIVEN
120VAC LINE IN 8 OHM LOAD

Fig. 2.6 Nominal Power Efficiency



LINE FREQUENCY HARMONICS PLOTTED TO THE FIFTH ORDER.

SPECTRUM TOTAL IS EQUIVALENT TO 1.25uV INPUT NOISE OVER A 20HZ-20KHZ BANDWIDTH.

Fig. 2.7 Nominal Noise Spectrum

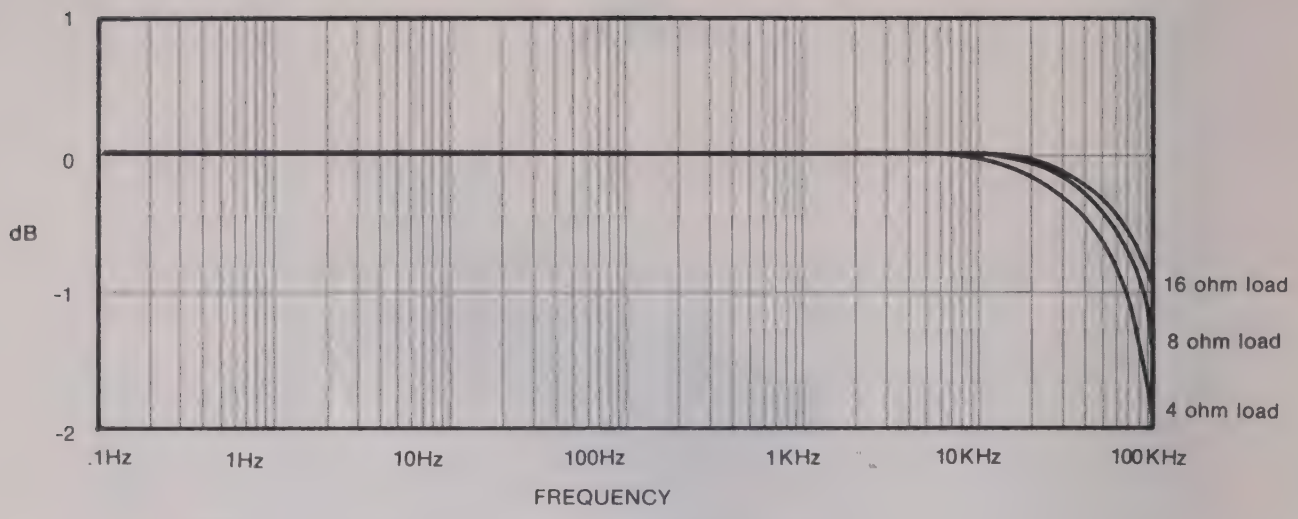


Fig. 2.8 Nominal Frequency Response

SECTION 3
INSTALLATION AND OPERATION

3.1 Unpacking

As soon as the unit is received, please inspect for any damage incurred in transit. Since the unit was carefully inspected and tested at the factory, it left unmarred. If damage is found, notify the transportation company immediately. Only the cosignee may institute a claim with the carrier for damage during shipment. However, Crown will cooperate fully in such an event. Be sure to save the carton as evidence of damage for the shippers inspection.

Even if the unit arrived in perfect condition, as most do, it is advantageous to save the packing materials. They will prove valuable in preventing damage should there ever be occasion to transport or ship the unit. Note the carton and internal pack - each is designed for protection during transit. DO NOT SHIP THE UNIT WITHOUT THIS FACTORY PACK!

Be sure to return the warranty registration yourself or through your dealer within ten days to receive your Care Card.

3.2 Accessories Supplied

The D-150A Series II comes complete with the following:

One instruction manual
2 dual banana plugs
4 nylon washers
4 10-32 trusshead ½" black screws

3.3 Mounting

Angle brackets have been supplied for rack mounting the D-150A Series II into a rack-style cabinet or a cabinet of your own design.

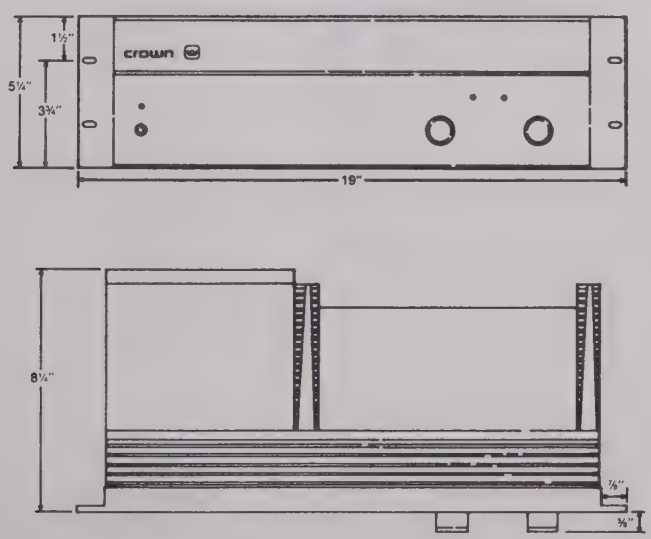


Fig. 3.1 Mounting Dimensions

Sufficient ventilation must be provided for the unit to prevent it from overheating. Applications requiring long, sustained signals at high power levels may require the use of a cooling fan. When rack mounting, it is a good practice to allow a 1¾" space above and below the unit. (See Fig. 3.1 for mounting dimensions.)

3.4 Operating Precautions

The following are a number of operating precautions given as an aid to understanding proper and improper amplifier usage.

1. Use care in making connections, selecting signal sources, and controlling the output level. The loudspeaker you save may be your own. Crown is not liable for any damage done to loads due to careless amplifier usage and deliberate overpowering. For pointers on load protection see Section 3.10.

2. Never parallel the two outputs by directly tying them together or parallel them with any other amp's output. Such connection does not result in increased power output. Damage incurred by such operation is not covered by the warranty.

3. Never drive a transformer-coupled device or any other device which appears as a low frequency short (less than 3 ohm) without a series isolating capacitor. Such operation may damage the device and/or needlessly activate the V-I limiting.

4. Do not short the ground lead of an output cable to the input signal ground as oscillations may result from forming such a ground loop.

5. Operate and fuse the amplifier only as set forth in Section 3.7.

6. Operate the amplifier from AC mains of not more than 10% above the selected line voltage and only on 50, 60 or 400Hz AC. Failing to comply with these limits will also invalidate the warranty.

7. Never connect the output to a power supply output, battery, or power main. Damage incurred by such a hookup is not covered by the warranty.

8. Do not expose the amplifier to corrosive chemicals such as soft drinks, lye, salt water, etc.

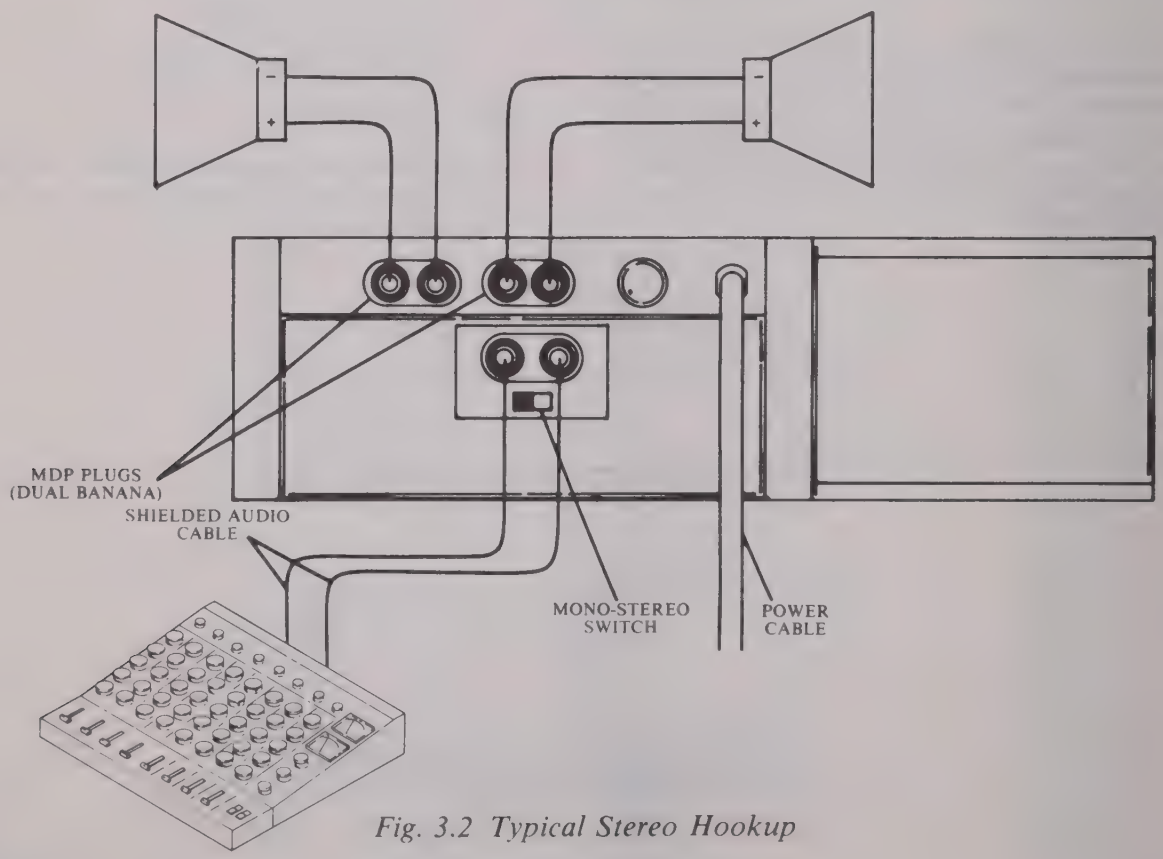


Fig. 3.2 Typical Stereo Hookup

9. Tampering in the circuity by unqualified personnel or the making of unauthorized circuit modifications invalidates the warranty.

3.5 Input/Output Connections

A typical stereo hookup is shown in Fig. 3.2.

It is always wise to remove power from the unit and turn the input level controls off while making connections. This will eliminate any chance of loud blasts damaging your speakers.

Crown is not liable for damage incurred at any transducer due to its being overpowered! The use of the speaker fuses is therefore highly recommended.

Before making connections, it is recommended that the operator familiarize himself with the amplifier's protective system. See Section 3.8, 3.10. Section 3.4 entitled "Operating Precautions" should also be read.

Because of the locations of the output connectors (color-coded binding posts) it will be easiest to make these connections first. High-quality, dual "banana" plugs are the preferred connectors for permanent installations.

For electrostatic speakers (if the manufacturer has not provided a capacitor) an external non-polar capacitor of 590-708 mfd and 4 ohm power resistor should be placed in series with the positive (+) speaker lead. This will prevent large low-frequency currents from damaging the electrostatic transformer or from unnecessarily activating the D-150A Series II's protection system. An effective test to determine if such parts are needed is to measure the DC resistance between the output terminals with an ohmmeter. If the resistance is less than 3 ohms, the parts should be added as shown schematically in Fig. 3.3.

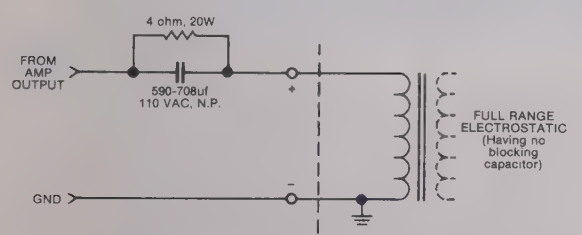


Fig. 3.3 Schematic for Full Range Electrostatic Speaker Connection

Because the output wire gauge and length raises the resultant source impedance or lowers the Damping Factor by adding series resistance, the nomograph (Fig. 3.4) is provided for wire selection. For dynamic moving-coil loudspeakers the value R_L should preferably be that measured by an ohmmeter across the voice coil, rather than the manufacturer's rating. For electrostatic speakers and such, the manufacturers's rated impedance should be used for R_L.

If the load (matching transformer, inductance, or full-range electrostatic speaker system) appears as a shor-circuit at low frequencies, a large non-polarized capacitor (paralleled with a resistor) should be placed in series with the load.

When selecting connectors for the load (speaker) end of the output lines, the following general precautions apply: (with all power connectors)

1. A male plug, carrying signal, must not be on the far end of the line where it can be exposed giving rise to both shock and short-circuit hazards.

2. Connectors which might accidentally cause the two channels to be tied together during making and breaking of connections should not be used. A common example is the standard 3-circuit ¼-inch phone jack and plug when wired for stereo sound.

3. Connectors which can be plugged into AC power receptacles should never be used.

4. Connectors having low-current-carrying capacity are "verboten."

5. Connectors having any tendency to short, or having shorted leads, are inadvisable.

A mono-stereo switch on the rear panel adjacent to the input jacks, allows the D-150A Series II to be operated normally (stereo) or in mono, with no internal modification. (See Fig. 3.5) When in the mono position, the input circuitry of the D-150A Series II is changed so that the two amplifiers are "added" for mono output. (See mono specifications, Section 2.2.)

Care must be taken in the external hook-up to assure proper operation. Proceed as follows:

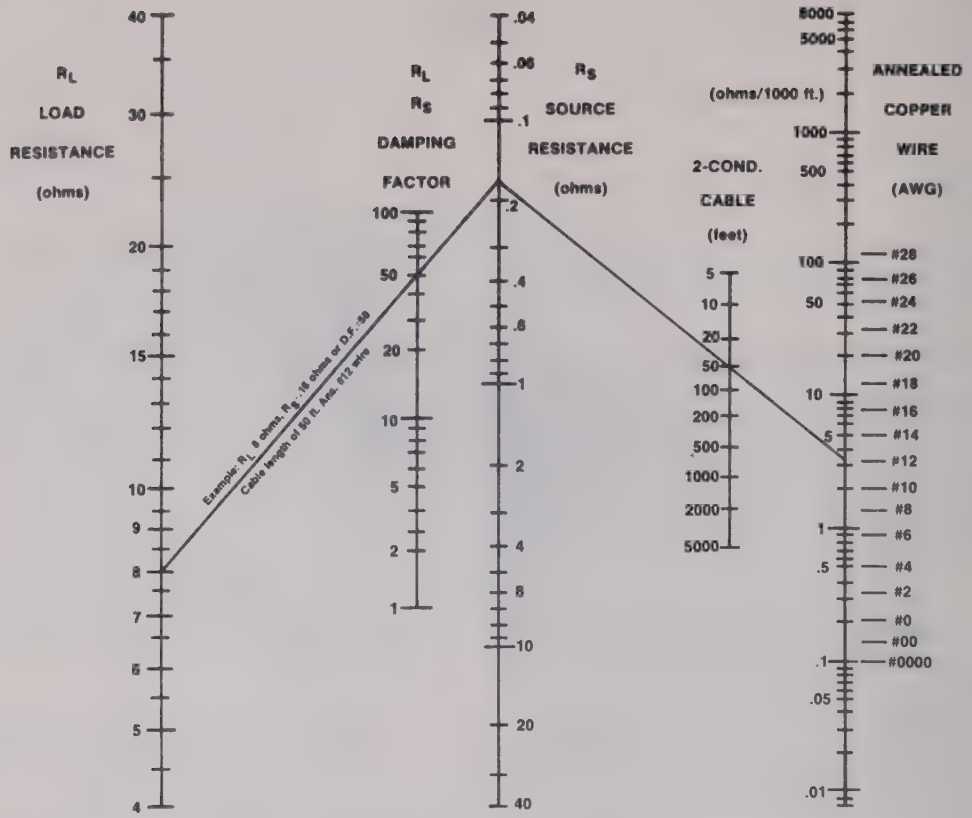


Fig 3.4 Source Resistance and Damping Factor vs. Length and Size of Output Leads

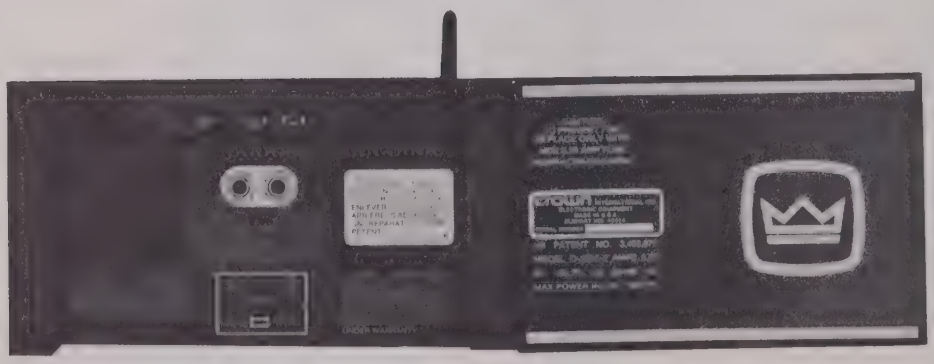


Fig. 3.5 D-150A Series II Rear Panel

1. The input line should be plugged into the Channel 1 input jack. The level is adjusted with the Channel 1 input level control.

Note: The Channel 2 input jack and level control are not defeated in the Mono mode. However, the Channel 2 input should not be used in this mode. If a Channel 2 input is added to the Channel 1 input, distortion may result. If Channel 2 input is used alone, very low power output will result. For best results unplug the input to Channel 2 when operating Mono.

2. Connect output lines as per the following drawing, Fig. 3.6. The output from the D-150A Series II in Mono is BALANCED and is isolated from the chassis, and from the input grounds to the D-150A Series II.

Caution: Be certain that all equipment (meters, switches, etc.) connected to the Mono output lines is balanced. Both sides of the line must be totally isolated from the input grounds to the D-150A Series II. If this is not observed, severe oscillation may result.

Connecting the inputs will require observance of three basic precautions: undesirable signals to the inputs, "ground loops," and feedback from output(s) to input(s).

For loudspeaker-driving applicatons, the input should be free of DC or large sub-audio or undesired low frequencies, as they cause overheating and overloading of the loudspeaker. To remove such low frequencies, a series capacitor may be placed in the input signal line. (The graph of Fig. 3.7 indicates the effect of the size of the capacitor on the frequency response.) Only a low-leakage paper, mylar, or tantalum capacitor should be used for this purpose.

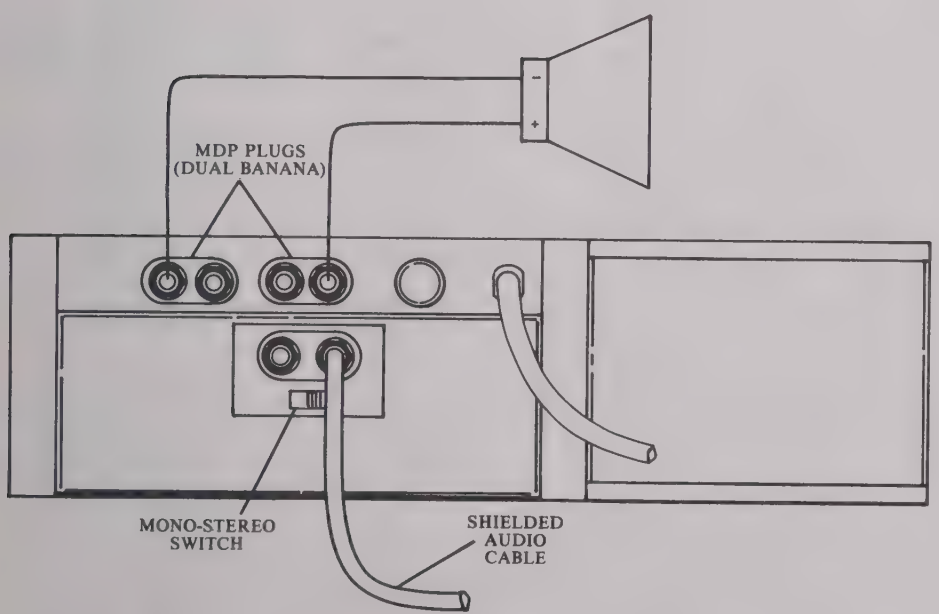
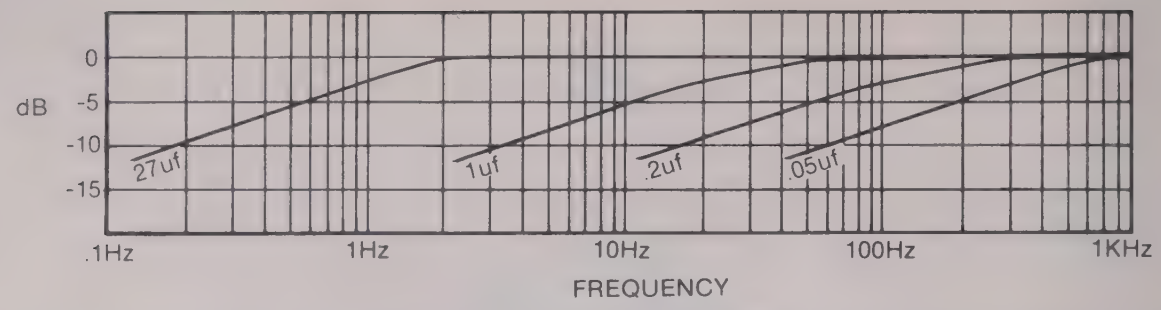


Fig. 3.6 Mono Hookup



NOTE:

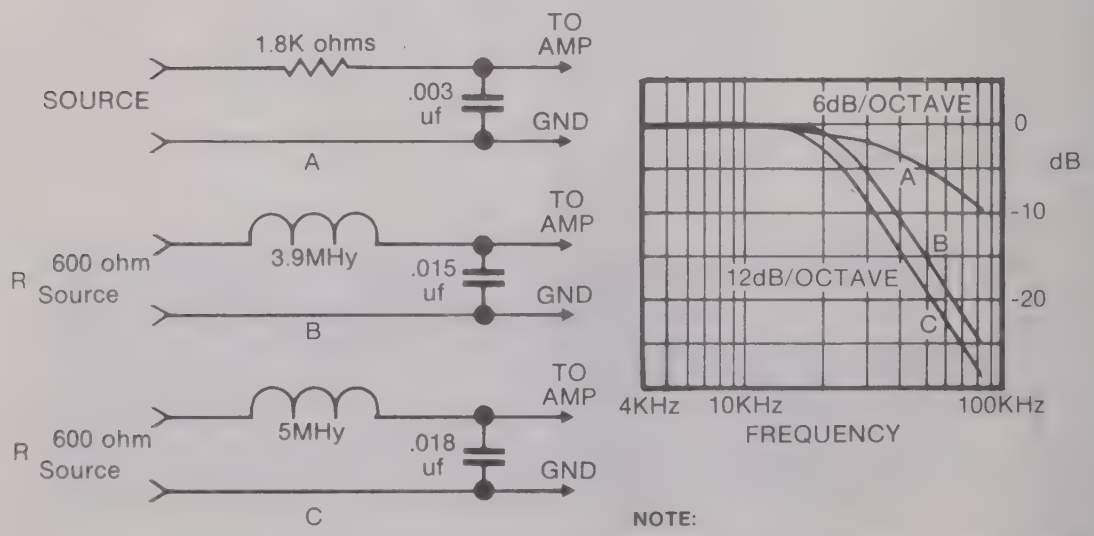
GRAPH DENOTES 10 K OHM INPUT Z (AMP LEVEL CONTROLS FULL CLOCKWISE)

Fig. 3.7 Graph for Selection of Input Capacitor

If large amounts of ultrasonic or RF frequencies are found on the input, such as bias from tape recorders, etc., a low-pass filter should be placed on the input. While practically-obtainable RF input levels will not damage the amplifier, they may cause burn-out of tweeters or other sensitive loads, activate the amplifer's protection system, or cause general overload in the controlled-slewing-rate stage of the amp (which is employed to provide RF overload protection). The following filters are recommended for such applications. (See Fig. 3.8).

resulting in hum in the output) is a pair of input cables whose area is subjected to a magnetic hum field. In practice, both cables should lie together along their length, and away from the power transformer. Tying the input and output grounds together may also form a ground loop.

A third precaution (with input and output grounds together, as in testing or metering) is feedback oscillation, from load current flowing in the loop. In industrial use,



NOTE:

A LO-Z Rs CAN BE INCREASED TO 600 OHMS BY AN APPROPRIATE RESISTOR.

Fig. 3.8 Low-pass Filter for Severe RF at Inputs

A second precaution is "ground loops" - electronic jargon for undesirable circulating currents flowing in a grounding system. A common form of loop (possibly

even the AC power line may provide this feedback path. Proper grounding, and isolation of inputs, of common-AC-line devices is good practice.

3.6 Connecting Power

The amplifier is furnished with a three-wire AC plug as standard equipment. Adapters are readily available commercially for adapting this to a two-wire system if necessary.

Only a competent technician should attempt alteration of the line voltage connections.

The amplifier offers five standard line-voltage connections: 100, 120, 200, 220, and 240VAC. The tag attached to the line cord indicates for which voltage the amplifier is connected. Most units are connected for 120 VAC. For operation at another line voltage, the unit must be converted to the proper input connection. Follow the following steps:

1. Remove the two rack ears from the front panel (4 socket cap screws).

2. Remove the front panel (6 screws).

3. Position the front panel to gain access to the transformer leads. Locate the two terminal strips (terminals A, B, C, D, E).

4. Determine the correct connection from Fig. 3.9 and solder the leads accordingly.

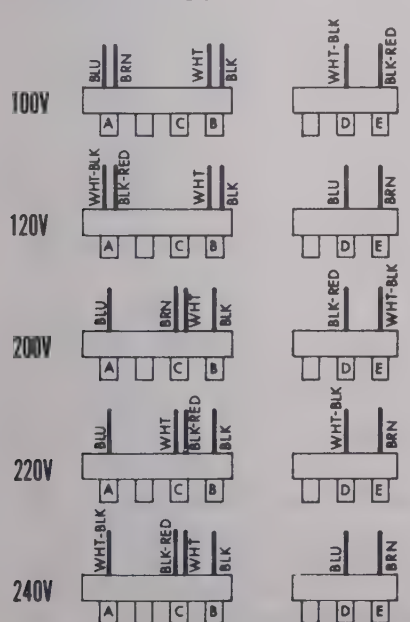


Fig. 3.9 AC Mains Voltage Conversion

5. Carefully check all connections, then repeat steps 1 and 2 in reverse.

Note: For all connections 200, 220 and 240VAC, the line fuse, F1, is changed to a MDA 3 amp.

When testing the amplifier, the line voltage must be the peak equivalent to a sinusoid of the indicated line voltage when at full load. Line regulation problems can introduce serious errors in the measurements on an amplifier of this size.

3.7 Controls and Adjustments

The D-150A Series II contains all the facilities essential for a high performance amplifier.

On the front panel are located independent level controls, a power switch, and a pilot light. There is an AC line fuse on the rear of the unit. Also on the front panel of the D-150A Series II power amplifier, Fig. 3.10, are 2 red IOC LED's. When lit, they will indicate when the distortion specifications of the amplifier have been exceeded. These LED's (one per channel) are located above each input level control.

The IOC indicators will normally come on after the AC power is turned off, and will stay on for about a minute.

The input level controls should be adjusted for the desired output level. Amplifier gain is 26dB as determined by 1% precision resistors in the D-150A Series II's feedback loop.

3.8 The Protection Mechanisms

The D-150A Series II is protected against all the common hazards which plague highpowered amplifiers - including shorted, open, and mismatched loads; overloaded power supplies; excessive temperature; chain destruction phenomena; input overload damage; and high frequency overload blowups.

Protection against shorted and low impedance loads is provided by the Signal Programmed Automatic Current Executor (SPACE control). It functions as an automatic current limiter at audio frequencies whose value of current limiting threshold is dependent on the history of the output signal. Output current causes the threshold to increase. The no signal threshold is high enough to allow tone bursting, (even into 4 ohms) without premature limiting as is found in some recent products of other manufacturers.

Fig. 3.10 D-150A Series II Front Panel

Since the limiter has no instantaneous response to output voltage, flyback transients do not appear in the output when limiting occurs on inductive loads. Flyback transients are a necessary response of a VI limiter (sometimes misnomered as "Energy Limiter") when limiting drive to an inductive load. The actual response of the flyback pulse is that the amplifier yields to the load resulting in a pulse emanating from the load which returns the inductive energy of the load to the opposite polarity power supply of the amplifier as that supply that produced the excessive output. The audible effect of flyback pulse is to produce a rasping, popping sort of sound which is not pleasing.

The current limiter will not yield to the load but will sustain the constant current demands of the inductive load without flyback.

Early amplifier designs frequently employed fixed current limiters but had serious difficulty with obtaining reliable low frequency output while being capable of full-voltage 4 ohm output. Also, many earlier designs used fragile epi-base or triple diffused outputs, which for reliable performance are poor mates for a current limiter protection scheme.The D-150A Series II uses two multiple epi-taxial silicon power transistors per channel. Their toughness allows the reliable use of a current limiter which when rendered signal variable permits large power outputs than would be safely allowable with a current limiter of fixed type.

At subsonic frequencies, the SPACE control behaves as a VI limiter and provides the increased protection needed at DC to prevent destruction due to heat build-up in the half of the output stage that is being driven.

The AC line for 120VAC is fused with a 6.25A, type MDX fuse (on 200, 220, 240VAC, 3A type MDA). The use of any other type of fuse will invalidate the warranty.

On the chassis is mounted a thermal switch which protects the amplifier against insufficient ventilation. If it becomes too hot, the AC line power will be interrupted until the temperature falls to a safe level, whereupon power will automatically be restored. When such an event occurs the external symptoms are: no output, and a warm amplifier.

All the amplifier's voltage-amplifier circuitry is designed to be inherently current-limited. Thereby, if any of the devices should fail, (which is extremely unlikely), no damage will occur to the rest of the stages.

The input stage is protected against overdrive damage by a series limiting resistor should the input signal level ever become excessive.

The amplifier features a controlled slewing rate which, coupled with the SPACE controller, protects the amplifier from blowups when fed large RF input signals.

3.9 Load Protection Methods

The most common of all protection schemes is a fuse in series with the load. The fuse may be single, fusing the overall system. Or, in the case of a multi-way speaker system, it may be multiple with one fuse on each speaker.

Fuses help to prevent damage due to prolonged overload, but provide essentially no protection against damage that may be done by large transients and such. To minimize this problem, high-speed instruments fuses such as Littlefuse 361000 series are most appropriate for such applications. For a nomograph showing fuse size vs. loudspeaker ratings refer to Fig. 3.11.

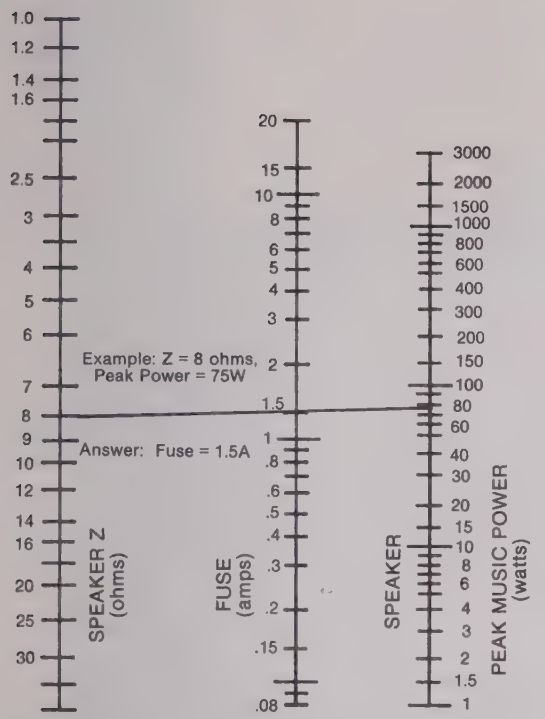


Fig. 3.11 Fuse Selector Nomograph for Loudspeaker Protection

Another form of load protector is shown schematically in Fig. 3.12. Whenever the load is overdriven, a relay switches a lamp in series with the load, smoothly relieving the overload. The lamp then doubles as an overdrive indicator as it glows. If overdrive is unreasonably severe, the lamp will serve as a fuse. By adjusting the relay tension adjustment and the protection level control, this system is useful from 25 to 200 watts for a typical 8 ohm load.

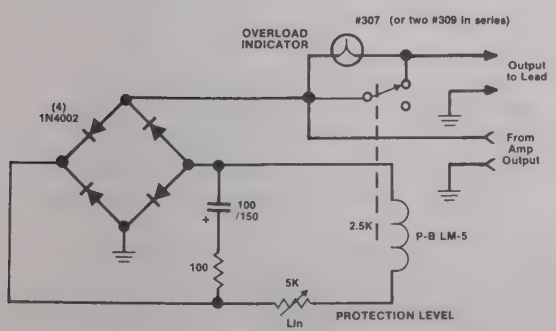


Fig. 3.12 Relay Controlled Protector with Overload Indicator

SECTION 4
TECHNICAL INFORMATION

4.1 General

The D-150A Series II has two totally direct-coupled amplifier circuits which employ a dual IC op amp and silicon transistors in all stages. The Crown designed and developed circuit represents a level of quality and performance unequaled in the field of audio amplifier design.

4.2 Principles of Operation

As is implicit in the term "totally direct-coupled," the D-150A Series II has a perfectly flat frequency and phase response extending to 0Hz or DC. Flat to DC response results in not only low frequency amplification with absolutely no phase-distortion, but also in perfect overload characteristics. Non-symmetrical waveforms (such as music) cause overload thumping in all currently produced AC amplifiers. These same amplifiers may, however, show no signs of thumping when fed a symmetrical test wave form such as a sinusoid. DC frequency response combined with ultra-low noise and IM distortion results in the closest approach to a "straight wire with gain."

Another characteristic of a DC amplifier is the thump or pop produced at turn-on and turn-off. For example, at turn-on the input amplifier requires a finite period of time to reach operating levels. During this time the output could be driven to large DC offsets resulting in annoying thumps.

A supply voltage detector virtually eliminates this problem in the D-150A Series II. The detector disconnects the regulated supply voltages to the output stages during these turn-on and turn-off periods, thus not allowing the DC offset at the output to occur.

The dual IC op amp is of a low noise type having a large gain bandwidth. The result of using it for the input voltage amplifier is that a maximum amount of feedback is applied reducing distortion to record low values. This has been confirmed by measurement with an elaborate test setup employing Crown-developed solid state variable filters and wave analyzing equipment. No other presently available harmonic distortion test apparatus is capable of such low residuals. The D-150A Series II's low distortion is achieved by employing multiple feedback loops to allow a maximum of total feedback.

The IOC (Input Output Comparator) circuitry works in conjunction with the error correcting signal of the main op amp. Any time a small "non-linearity" exists in the amplifier, an error signal appears at the output of the main op amp (via the feedback loop of the unit). This produces an abnormally high value, exceeding the "window" of the IOC and illuminating the LED. Since transient overload can happen rapidly, a pulse stretching circuit is added so the eye can detect the LED lighting.

The lack of noise is evidenced by a typical 20Hz-20KHz effective input noise of 1.25u volts which produces an effective 8 ohm output of 80 micromicro (pica) watts.

The output stage is a quasi-complementary format employing the Crown class AB+B technique which uses no bias current in the output transistors. The result is maximum efficiency with minimum crossover notch distortion and amplifier idling heat. Thus there is no bias current adjustment, as the output circuit is not temperature-tolerance critical. Temperature drifts of bias are further controlled by bias servos which are mounted on the heat sinks.

In the AB+B output circuit, the driver transistors carry the bias current, while the output transistors serve only as boosters. The output transistors sense when the driver transistors are delivering significant current to the load and take over and deliver the large load currents.

Protection against shorted and low impedance loads is provided by the Crown-developed SPACE (Signal Programmed Automatic Current Executor) control circuit. It functions as an automatic current limiter at audio frequencies and as a VI limiter at subaudio frequencies. The threshold of current limiting is dependent on the history of the signal, yet the no-signal threshold of current limiting is high enough to allow full power tone bursting. The net result is total protection with a maximum of headache-free output power

requiring neither an inventory of special fuses or cumbersome load matching techniques.

The monolithic input amplifier stages result in extremely low DC drift. The input terminal bias current is offset by a unique temperature compensated source resulting in a laboratory amplifier needing no user-accessible offset controls.

The input amplifiers are powered by zener-regulated power supplies. The bias regulators are also powered by zener-regulated current sources with the result that line voltage variations do not cause noise or distortion due to misbiasing.

The power supply is a continuous-duty type. The main DC supplies are full-wave capacitor input type with heavy-duty, chassis heat-sinked diodes. Computer grade electrolytics furnish over 20 joules of energy storage. A higher voltage at low current is derived from a half-wave voltage-doubler circuit. This voltage is used in the amplifier's driver circuit.

The D-150A Series II represents nothing short of the highest quality in both circuitry and components. It should provide a lifetime of trouble-free service for the most discriminating users.

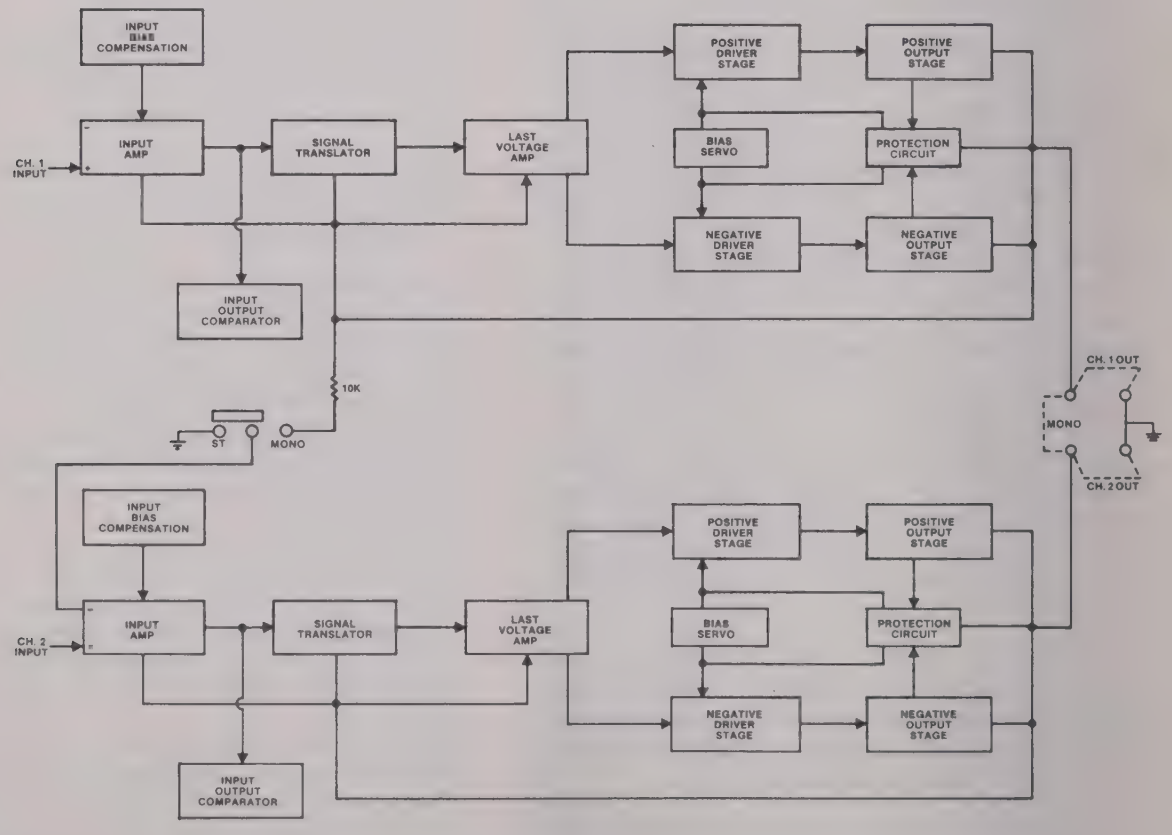


Fig. 4.1 D-150A Series II Block Diagram

crown Proof of Performance Report

D-150A Series II Professional Power Amplifier

Serial Number 054568

Technician Linda O'Neal

Line Voltage Requirement 120 VAC

Amcron Label

		Ch. 1		Ch. 2
1.	Quies. offset of less than 10mV			
2.	1KHz 90 watts RMS minimum into 8 ohms, per channel, both channels operating, 0.1% total harmonic distortion			
3.	4 ohm test			
4.	Protection tests			
5.	Reliability test			
6.	20KHz 80 watts per channel minimum RMS (both channels operating) into 8 ohms 0.05% total harmonic distortion			
7.	10KHz square wave			
8.	Mono operation			
9.	IM Distortion into 8 ohms (%) (60-7KHz 4:1) S.M.P.T.E.	.002	80W	.002
		.002	25.3W	.002
		.002	8.0W	.002
		.002	2.53W	.002
		.002	.8W	.002
		.003	253mW	.003
		.006	80mW	.005
		.016	25.3mW	.010
		.010	8.0mW	.009
10.	Hum and Noise - dB below 80W into 8 ohm (20Hz-20KHz)	-122 dB		-122 dB
11.	Quies. AC power input at 120 VAC	70		

MODEL	BAT	SER NO
D-150A-2	17	054568

"TOTAL PERFORMANCE IS WHAT COUNTS"

CROWN test and check-out procedures reflect our basic design philosophy; we believe that reliability can be engineered into a product. As such, our check-out is designed to expose and correct a problem, before it happens. This testing begins when the unit is still a pile of parts; grading and selection of components is standard. The final test-inspection is the culmination of this vigorous program, but our concern doesn't stop here. Our products are backed by an extensive field service program, and protected by a comprehensive warranty.

A word about our testing procedure is in order. All our specifications are referenced to an AC input of 120 VAC. The high current demand with high power tends to cause the line voltage to sag, or the sinusoidal waveform to distort. With a distorted waveform (or lower line voltage) the peak voltage is lowered. Since it is the peaks that charge the filter capacitors in the amplifier power supply, and thus determine the maximum power output, a line voltage problem reduces the maximum power output. CROWN uses a peak equivalent AC voltmeter which measures the peaks of any waveform and converts this to an equivalent rms reading for a sinusoidal waveform. This way we can vary or regulate the line voltage, no matter how distorted the waveform, to an equivalent of a 120 VAC sinewave. We are then measuring a true maximum output power.

With regard to the precision load which we use for our testing, we realize that a resistive load is quite different than a reactive speaker. However, using readily available parts, a precision resistive load is the easiest to duplicate, with respect to obtaining consistent results. We specify that the load must be resistive, having less that 10% reactive component at any frequency up to five times the highest test frequency. The resistance value should be maintained within 1%, at all power levels.

The following discussion examines each of the test procedures listed on the facing page. This is an attempt to help you understand, in layman's terms, what the tests mean.

1. **Quiescent Offset** - This simply assures that your amplifier's output is balanced with reference to its input. Thus the amplifier will not "bias" the program with a dc component. To meet specifications, offset must be less than 10 mv.

2. **1KHz** - This test measures the power across an 8 ohm load at a frequency of 1KHz with both channels operating. This is a determination of how much power an amplifier can produce before a specified total harmonic distortion is reached. For the D-150A Series II, the power is 90 watts at less than .1% THD.

3. **4 Ohm Test** - This is a critical examination of the D-150A Series II's performance at impedances below that for which it is rated. We check the wave form for level (it must reach a specified voltage before clipping) purity, and stability.

4. **Protection Test** - This is a test with a 2 ohm load which determines the threshold at which the protection circuitry will be activated. Sharp clipping should occur with no evidence of instability. The positive and negative limiters operate independently and therefore may not be activated simultaneously.

5. **Reliability Test** - This test puts the output stages through an extremely vigorous thermal cycling. The test is a very low frequency input signal driving the output to full power across a short circuit for a predetermined period of time.

6. **20KHz** - This tests the amplifier at its rated power level. We specify that at any frequency between 1Hz and 20KHz the D-150A Series II will produce 80 watts minimum rms (both channels operating) into an 8 ohm load, at a sum total harmonic distortion of .05% or less. We choose 20KHz as the test frequency because high frequencies produce more heat than lower frequencies. Thus, if the amplifier can safely pass the 20KHz test, it will operated safely at lower frequencies.

7. **10KHz Square Wave** - This test critically examines the amplifier's frequency responce and rise time. (How fast the amplifier can follow rapid signal changes.) The Output square wave (with an 8 ohm load) should be clean and sharp, with no ringing or overshoot.

8. **Mono Operation** - This is a check for proper operation of the stereo mono switch. A signal is applied to channel 1 input only and the mono output is observed between the two red output terminals of the amplifier.

9. **IM Distortion Test** - At CROWN we feel that IM distortion testing yields a truer picture of amplifier performance than harmonic distortion testing. While a large amount of documentation supports this opinion, some of the reasons are apparent, even in layman's terms. For example, a sinusoidal waveform (used in HD testing) bears little resemblance to the complex waveform. Also, harmonic distortion is not always aurally offensive. The human ear may interpret such distortion as pleasing, but usually finds IM distortion rather obnoxious. In order to support this design philosophy, we designed and built our own IM analyzer with residual noise and distortion low enough to test our amplifiers.

10. **Hum and Noise** - This test, in plain English, tells you how small a signal can be amplified without it becoming "lost in the mud". The test is limited to the audio band width of 20Hz-20HKz, with a bandpass filter. Our specification for the D-150A Series II is: hum and noise from 20Hz - 20KHz will be at least 110db below the full power output of 80 watts. This means that with a 80 watt output the noise will be only .0008 micro watts. (That's 8 ten billionths of a watt!)

11. **Quiescent AC power Input at 120 VAC** - This test confirms that your amplifier is not drawing excessive power while "idling". If an amplifier exhibits a tendency toward instability, or oscillation, it may draw power with no signal input. The D-150A Series II will draw 40 watts or less at idle.

CROWN SHIPPING INSTRUCTIONS
FACTORY SERVICE

1. USE A STANDARD CROWN PACK

This method is the most reliable way of assuring the safe arrival of your unit to the factory. If you do not have a pack, simply call or write to the Crown Parts Department. Any other packing material, with the exception of polyurethane and wooden crates, will not be sufficient to withstand the "stress" of shipping. DO NOT USE SMALL SIZE, LOOSE PACKING MATERIAL.

2. SEND ONLY YOUR UNIT

Extensive damage will occur if the unit is shipped in any kind of cabinet (wood or metal).
ACCESSORIES ARE NOT NEEDED!
Do not send the instruction manual, power cord, cables, rack mount brackets, etc.

3. TAPE RECORDERS

Send the entire unit mounted on proper length angle iron braces.
Do not send accessories that do not pertain to the repair. Reel knobs, hub adaptors, instruction manual, power cord are not needed.
Again, please use a Crown Shipping Pack.

IF YOU HAVE ANY QUESTIONS, PLEASE CALL OR WRITE THE CROWN FACTORY SERVICE DEPARTMENT.

Detach and send in with unit.

SERVICE INFORMATION

Crown International, Inc.
1718 West Mishawaka Road
Elkhart, Indiana 46517
(219) 294-5571

Owners Name _____

Address _____

Unit Model _____ **Phone No.** _____

Serial No. _____ **Purchase Date** _____

NATURE OF PROBLEM

(Include condition under which problem occurs and what has been done to try to correct it.)

_____

_____

_____

Additional Information *(Tape Type, Speeds, etc.)* _____

_____

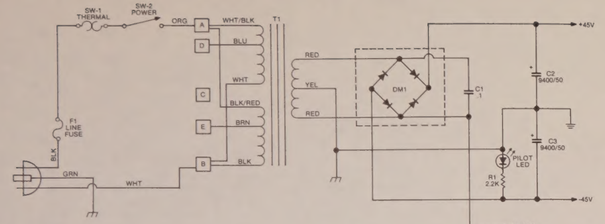
Other Equipment in the System

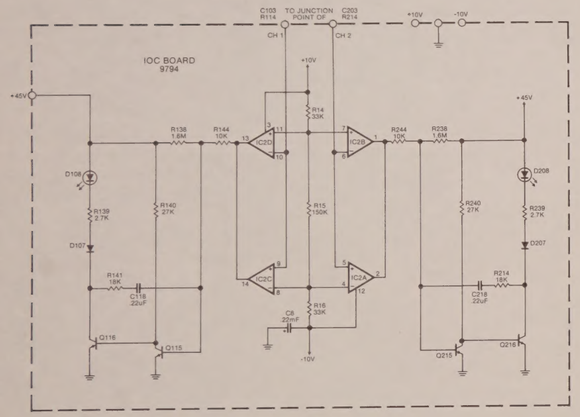
_____

_____

If warranty is expired, will the return shipment be: ☐ **Prepaid**
☐ **C.O.D.**

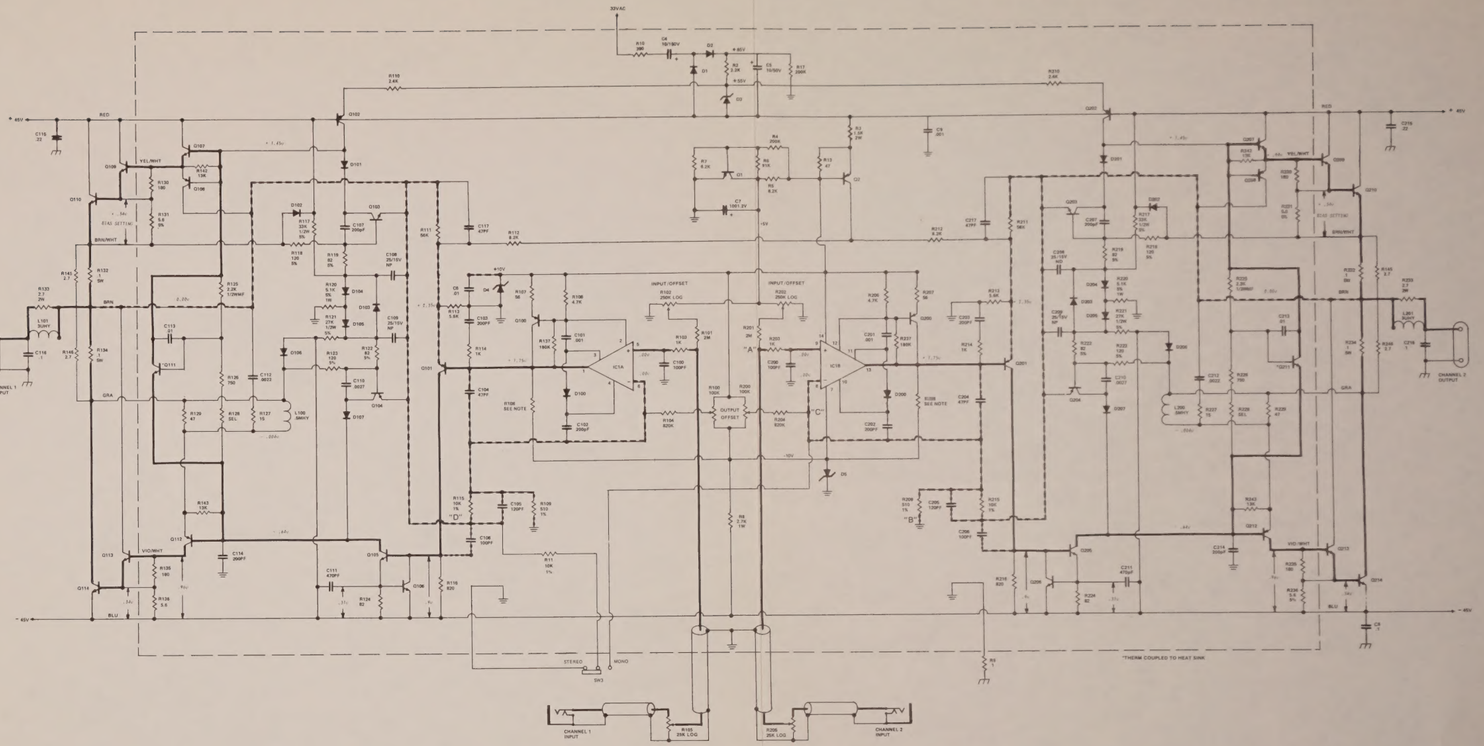
ENCLOSE THIS WITH UNIT
DO NOT SEND AHEAD





NOTES:

- THIS IS A REPRESENTATIVE SCHEMATIC ONLY AND DOES NOT NECESSARILY REFLECT THE EXACT CIRCUITRY OF YOUR UNIT. REFER TO SERVICE MANUAL FOR FURTHER TECHNICAL INFORMATION.
- THIS SCHEMATIC APPLIES TO AMPLIFIERS NUMBERED 51024 AND ABOVE.
- CIRCUIT SHOWN APPLIES TO PC BOARDS #9786 (MAIN BOARD) AND #9794 (IOC BOARD).
- DC VOLTAGES ARE SHOWN FOR VARIOUS POINTS. THESE ARE NORMAL OPERATING VOLTAGES FOR ZERO INPUT.
- WIRE COLOR CODES ARE GIVEN FOR THE MAIN POWER SUPPLY AND SOME BOARD WIRES.
- ALL RESISTORS IN OHMS UNLESS OTHERWISE STATED.
- ALL CAPACITORS IN MICRO-FARADS UNLESS OTHERWISE STATED.
- COMPONENTS COMMON TO BOTH CHANNELS ARE NUMBERED FROM 1 TO 99.
- CHANNEL ONE COMPONENTS ARE NUMBERED FROM 100 TO 199.
- CHANNEL TWO COMPONENTS ARE NUMBERED FROM 200 TO 299.
- R108, R208 ARE OMITTED WHEN IC-1 IS uA739; 3.3K WHEN uA749 IS USED.



D150A SERIES II
POWER AMPLIFIER
MI 261F